The Phased Array Terrain Interferometer (PathIn): A New Sensor for UAS Synthetic Vision and Ground Collision Avoidance, Phase II

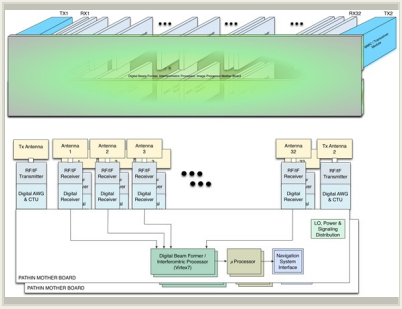
Completed Technology Project (2014 - 2019)

Project Introduction

This proposal introduces an innovative sensor to advance ground collision avoidance for UAS platforms by providing real-time height maps for hazard anomaly detection. This sensor will also provide enhanced vision to overcome reduced visibility in fog, drizzle and light rain and the detection of hazards/obstacles on runways for landing and takeoff applications. Specifically, this effort will build upon a developing synthetic vision system for landing piloted aircraft to: 1) customize the design and feasibility for targeted unpiloted autonomous systems (UAS), and 2) incorporate interferometry for terrain mapping and hazard detection. Dubbed "PathIn", the proposed sensor is comprised of a Ka-band digitally beamformed (DBF) radar interferometer that will provide a real-time data interface for ground-collision avoidance systems. The proposed effort is aligned with the effort to integrate UAS into the National Airspace (NAS). The Phase II will realize a prototype of the PathIn sensor, leveraging our extensive radar, interferometry and DBF experience and key technology capabilities. In particular a FPGA-based digital receiver system will be extended for real-time beamforming and interferometry. At the end of the Phase II, a technology readiness level of 5 will be achieved.

Anticipated Benefits

The immediate NASA application of PathIn is for Ka-band interferometry to provide 3D platform-relative mapping over a relevant field of view in support of safe UAS operation in the national airspace and also piloted operation during limited low visibility conditions (i.e. fog, drizzle, etc.). The PathIn Ka-band radar interferometer electronic vision systems would complement existing synthetic vision and automated ground-collision avoidance systems.In the commercial space, the need for landing systems to assist pilots in low visibility conditions is great. The NEXTGEN project and emphasis on improving airport runway utilization along with the savings in costs from aborted landings or delayed landings have combined to prompt the FAA to seek improvements in aircraft based systems to assist in this manner. A PathIn based 2D and 3D Electronic Flight Vision System (EFVS) would provide the measurements or imagery necessary to validate aircraft and runway location as well as hazard detection. Its integration into a Heads Up Display (HUD), showing anomalies detected with comparisons to the DEMs would provide Synthetic Vision Systems (SVS) with the verification and detection needed. Eventually, a PathIn based sensor could meet the FAA certification requirements to allow zero-zero (aircraft touchdown in zero visibility conditions) landing in the near future.



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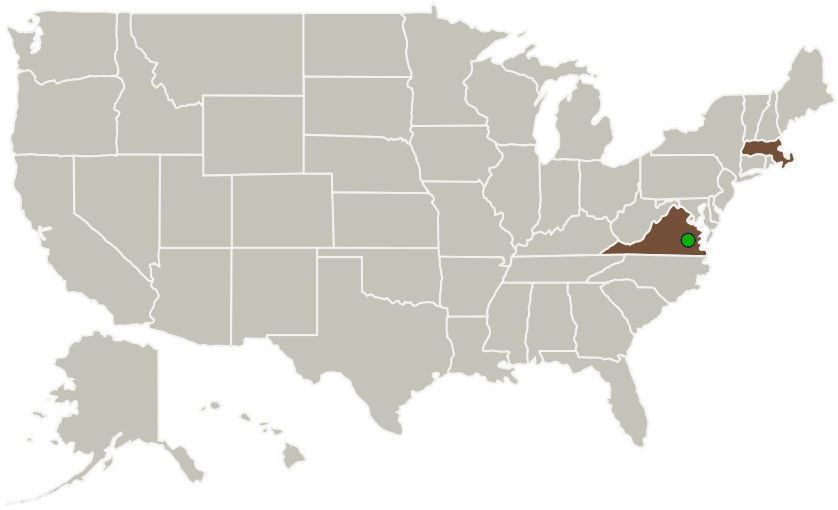
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Remote Sensing Solutions, Inc.	Lead Organization	Industry	Barnstable, Massachusetts
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Massachusetts	Virginia

Project Transitions

April 2014: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Remote Sensing Solutions, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Managers:

Keith L Woodman
Charles B Lunsford

Principal Investigator:

James K Carswell

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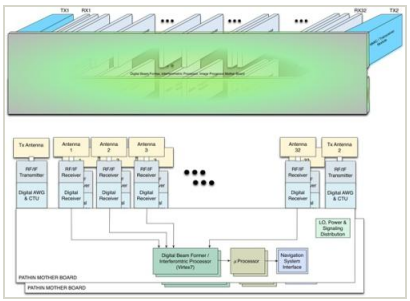
March 2019: Closed out

Closeout Summary: The Phased Array Terrain Interferometer (PathIn): A New Sensor for UAS Synthetic Vision and Ground Collision Avoidance, Phase II Project Image

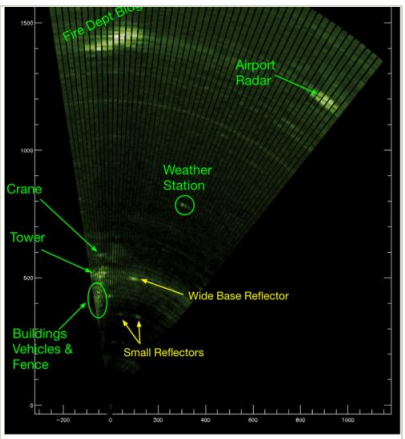
Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/140693)*

Images



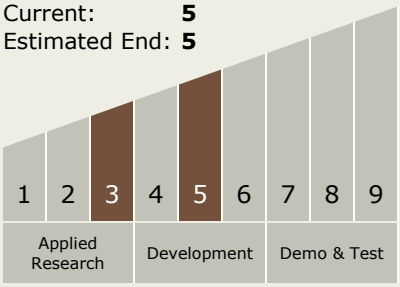
Briefing Chart Image
The Phased Array Terrain Interferometer (PathIn): A New Sensor for UAS Synthetic Vision and Ground Collision Avoidance, Phase II
(https://techport.nasa.gov/image/125988)



Final Summary Chart Image
The Phased Array Terrain Interferometer (PathIn): A New Sensor for UAS Synthetic Vision and Ground Collision Avoidance, Phase II Project Image
(https://techport.nasa.gov/image/132665)

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System